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PROTECTING CROPS FROM DAMAGE BY HORNED LARKS IN CALIFORNIA

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INTRODUCTION

In certain parts of California the horned lark has become a serious crop destroyer. The damage occurs mostly in the interior valleys from Sacramento south to the Imperial Valley, and along the coastal strip from San Francisco south to San Diego. The race of lark concerned throughout most of the area is the California horned lark (Otocoris alpestris actia). There are a few recorded instances near Sacramento of damage by the ruddy horned lark (Otocoris alpestris rubea). Certain attacks in the Mojave Desert region, the Imperial Valley, and other desert valleys in southeastern California were probably committed by other and as yet undetermined subspecies.

A bird fond of deserts, prairies, and fallow fields, in general, the horned lark ranges from the snow line to sandy beaches, wherever there is open country. After wintering in great numbers on the valley floors, most of these birds leave the farming sections early in spring and migrate into the foothills or into the dry grasslands and desert. Here the season of nesting and rearing the young is spent.

There is a moderately constant population of horned larks resident in stubble, grass, and fallow fields in the cropped area, but the mass of the birds live in the wide expanses of the deserts, rolling mesas, foothills,

NOTE.--This leaflet supersedes Wildlife Research and Management Leaflet BS-64, issued in September 1936 by the former Bureau of Biological Survey, of the Department of Agriculture.

and dry grasslands that encircle the farming areas. During May and June the young of resident horned larks may be noted about the fields. Beginning usually late in June or early in July, when the early broods of youngsters are just able to travel extensively, there is a movement from the open country into the general farming district, and the population of horned larks in the latter areas may show a sudden and great increase. Further increases in numbers may be noted throughout the remainder of the summer and early fall, as additional bands flock in from their open-country range.

"The food of the horned lark consists largely of seeds picked up from the ground." This statement by Beal is virtually as true today as it was when Beal wrote it in 1910.1/ Analysis of the food items contained in 259 horned lark stomachs collected in California showed the annual food of the birds to consist of about 91 percent vegetable, and 9 percent animal, matter. Among the vegetable foods Beal listed cultivated crops of corn, wheat and oats. Seeds of weeds and wild grasses averaged 51 percent of the total food. Insects were taken largely from March to June, and many of them were fed the young.

Study of a small series of stomachs collected at a later date reveals little change except that the birds' liking for succulent vegetable crops, practically unknown in Beal's time, has accentuated their vegetarian preferences. In much of the State the item most frequently found in the stomachs of horned larks is the seed of redmaids (Calandrinia caulescens menziesii), which grows in profusion over a wide area. Other seeds commonly found are those of smartweed (Polygonum), alfilaria (Erodium), rye grass (Lolium), spurrey (Spergula), campion (Silene), and tarweed (Hemizonia). When available wheat, barley, oats and milo maize may be taken from newly seeded grainfields, or from stubble. Insect food during the period of crop damage is unimportant.

CROPS DAMAGED

Horned larks are given great opportunity for damage by the widespread abundance of cultivated products attractive to them. In the irrigated valleys almost all kinds of green table vegetables are raised, large acreages of vegetables and sugar beets are grown for seed, and beans cultivated for the dried product. In these valleys also are great flower-seed producing areas. On the lower hills and unirrigated rolling lands additional thousands of acres of similar crops adapted to dry-farming are grown. Production continues somewhere in the State throughout the year.

Among the vegetable crops severly damaged by horned larks are lettuce, carrots, beets, spinach, turnips, and peas. Plantlets of field and truck crops destroyed include those of black-eyed peas, beans of nearly every type, sugar beets, cantaloupes, watermelons, and tomatoes. Flower plantlets of many varieties, in commercial seed plantings, are frequently devoured.

1/ Birds of California in Relation to the Fruit Industry, part 2, by F. E. L. Beal. Biological Survey Bulletin No. 34, 96 pp., illus., 1910.

NATURE OF DAMAGE

Damage by horned larks usually begins as the first plants break through the surface of the soil, and it may continue until the plants reach a height of several inches. The horned lark nips off parts of the tender plantlets, or in the case of small, weak-rooted seedlings such as lettuce, it may pull up the entire plant. In any event, if nipped off below the crown, the plantlet dies. In more robust kinds, such as beans, the first cotyledons may be nipped off, the plant being thus destroyed. If the seedling is not destroyed in any early stage, secondary leaflets and adventitious buds are speedily consumed as they appear. They are often pruned back so persistently that the plants are permanently dwarfed and as a result produce no fruit or seed.

Although the most severe attacks are usually upon tender plantlets, in certain years extensive depredations have occurred upon bean and pea blossoms late in the summer. This may be so serious as virtually to wipe out the crop in an entire district. In a few instances horned larks have been observed picking the outer leaves of head lettuce to such depth that excessive waste was occasioned in discarding the perforated leaves. In one case it was noted that as turnip seedlings appeared through the ground, the birds literally dug up the drill-track to feed upon the germinating seeds.

Laboratory analysis of the stomach contents of horned larks engaged in these attacks usually fails to give an accurate idea of the damage done. A certain quantity of the green vegetable tissue will be found in the stomachs of the birds; yet in many instances it is noted that by far the major part of the plant tissue torn from the plantlets is dropped on the ground; furthermore, many plantlets may be pulled up or broken off and left without any evidence of the removal of any of the leaves. Probably depredations upon green crop plants result from a search for moisture.

On dry-farmed areas, where plant growth is slow, the damage may extend over a long period and thus cause excessive loss. In irrigated fields, where the plants grow rapidly, the attack is usually of relatively short duration. On the other hand, irrigation of fields in an otherwise arid area devoid of green vegetation may cause an abnormal concentration of birds, resulting in severe losses.

The first evidence of damage by horned larks is usually the denuding of plants from a small area near the center of a field, distant from cover or fences. As the attack continues the bare spot may spread with startling rapidity, until in severe depredations only a narrow fringe of undamaged plants may remain about the borders of the field.

SEASON OF DAMAGE

In general, attacks by horned larks upon crops are closely correlated with the dry season. Most of the depredations occur after the natural vegetation of the surrounding range or grassland has dried up, and they may continue until the first fall rains come. Because of the great variation in conditions within the State, one can say only that the greater part of the damage occurs between mid-June and November.

Several periods of subnormal rainfall have brought increased damage to crops by these birds, apparently because of scarcity in their natural habitats of vegetative growth necessary for food. In contrast, in the winter of 1934-35 an abnormally heavy rainfall occurred over the entire State, and during the summer of 1935 damage by horned larks averaged less than 20 percent of that inflicted during the preceding five-year period.

Depredations cannot be entirely blamed on aridity, however, for sporadic attacks occur even during midwinter after heavy rainfall. Damage is noted also on slopes immediately adjacent to the ocean where moisture always is present. Moreover, these birds exhibit at times a marked propensity to continue feeding upon certain fields once they have acquired a taste for the succulent young plants, even though an abundance of natural food may be available in closely adjacent areas.

In many districts it has been necessary to modify cropping methods to guard against the attack of the larks. In certain areas crops especially sought by them are no longer planted; summer-growing crops are, if possible, planted in May in order that the plants may be large enough to escape the attack that begins late in June; and winter-growing crops are often not sown until after the first rains in the fall; even then, a prolonged fall drought frequently occasions a severe bird attack.

SEVERITY OF DAMAGE

The severity of attack naturally varies with seasonal and topographic circumstances, crop production methods, availability of natural foods, and with the density of the horned lark population. It must also be considered in computing economic losses that some of the crops attacked require an especially fertile, hence high-priced, soil. The cost of preparing the soil for seeding often is increased by specialized methods demanded, and irrigation and cultural methods add to the overhead, making the culture of some of these crops a costly undertaking. Losses are therefore keenly felt.

Innumerable records of estimated losses from depredations and costs of control operations are available, from which only a few illustrative examples are noted. In 1927, near Murray, in Kings County, a packing company planted 40 acres of spinach. Just as the plants began to emerge from the soil a concentration of horned larks destroyed approximately 34 acres of the crop within a 48-hour period. In 1932 the same company planted 240 acres of spinach in the same vicinity. Costs of $2,000 were incurred in labor and ammunition in an effort to protect the crop, yet fully 40 acres were totally destroyed. No spinach was planted in that area immediately thereafter.

In 1933 severe losses were suffered in Riverside County in plantings of sugar beets for seed. At that time American production of this seed was an infant industry, and the damage in retarding its development here was far greater than the cash appraisal of actual losses in time and material.

In 1934, in San Luis Obispo County an agricultural official estimated that fully 500 acres of beans and lettuce were destroyed. During the same period there was report from Santa Barbara County the loss of well over 1,000

acres of beans in the Santa Maria district alone; the writer personally inspected several ranches where fields as large as 200 acres were totally destroyed. During the same season, agricultural officials estimated that fully 1,500 acres of crops were destroyed in Monterey County. Numerous other instances are cited in "The Need for Studies in Bird Control in California," by W. L. McAtee,2/ and there are scores of other such reports in unpublished notes.

CONTROL METHODS

Methods that involve the killing of the horned larks are not discussed in this leaflet. Although such methods have been partially developed, their application is so involved with climatic, topographic, and ecologic conditions that it is not advisable to discuss them here; nor is it practicable to depend on them for crop protection except under occasional favorable local conditions. Their use is not recommended unless under trained supervision.

METHODS OF PREVENTING DAMAGE

The development of effective methods of preventing attack by horned larks has been progressive, limited only by the ingenuity of the persons concerned. It is the purpose of this leaflet to discuss briefly the various methods that have been seen in actual use and to comment upon their effectiveness.

NOISE-MAKING DEVICES

Sometimes one may see one or more men slowly patrolling a field in which crop damage is occurring and beating energetically and constantly upon tin pans or cans. This method is commonly practiced only where low-waged foreign labor is employed. Effective crop protection by its use demands so large a number of men for any sizable planting that it immediately becomes uneconomical and impractical. In any case, if too few men are used, the bands of horned larks drift along ahead or alight in another part of the field where they continue their feeding.

SHOOTING OR HERDING OFF

Herding off with guns has proved too costly in labor and ammunition, and is generally inefficient and impracticable. The horned larks keep just out of gun shot, and because of their groundlike color they are difficult to see at any distance. The Kings County packing company's planting of spinach in 1932, already mentioned, was patrolled by 24 men, one to each 10 acres, at a cost of $1,300 for labor and $700 for ammunition, yet a sixth of the planting was a total loss. Although some exceptions may be noted, this is a fair example of the futility of the herding method.

2/ California State Department of Agriculture, Monthly Bulletin XXI (4-6): 269-286. April-June 1932.

ATTRACTING VULTURES

In some sections the rancher obtains all the available heads of slaughtered cattle from the community slaughter house, mounts them upon short poles, and places them at intervals over the field. Some farmers collect all the available white chickens in the vicinity, kill them, and scatter the dead bodies at intervals over the field. Both these practices are based upon the theory that vultures, attracted by the baits, will frighten away the horned larks. These methods, however, are ineffective, as horned larks, coming from their roosting places in stubble or grassfields, generally appear in the fields soon after sunrise, whereas the vultures do not take wing until the air has warmed up, often two or three hours later. Hence the horned larks have considerable opportunity for feeding before the vultures appear. Furthermore, horned larks have been observed time after time feeding within 15 feet of vultures and evincing no fear.

The use of the dead white chickens, however, has a secondary effect of some slight value. As the carcasses are eaten by predators a mass of white feathers is liberated. In much of the area where damage by horned larks occurs, there is a strong breeze nearly every day, and the white feathers flutter across the fields before the wind. As long as feathers are moving in sufficient density, they have some effect in repelling larks.

SCARECROWS

A great variety of scarecrows has been devised. General faults of these are: First, that they are usually sparsely distributed, and second, that they have no motion. To remedy these faults costs more than other methods recommended. As a rule, scarecrows are rank failures.

One rancher built and placed in his field a number of home-made windmills with blades about 2 feed long. In the strong midday sea breeze common in that district the windmills whirl vigorously and make considerable noise. Horned larks remained at some distance from these machines, but the cost of placing them over a field in numbers sufficient to protect the crop would be prohibitive.

PAPER CONFETTI

One ingenious rancher, in a district which has a constant sea breeze, hit upon the idea of tearing old newspriht into small pieces and throwing them into the air at the windward margin of the field whence they were rolled and tumbled across the field by the breeze. As long as the density of torn paper was sufficient and the motion continued, horned larks avoided the field. Naturally the rancher tired of the constant attention demanded and did not continue the trial. Shortly afterward, horned larks came back into the field and destroyed almost the entire planting.

PAPERS ON THE GROUND

The first of the methods here discussed that appear to have any continuing protective effect is that of placing pieces of paper on the ground, weighted down with clods of earth. The degree of success depends upon the frequency of distribution of the papers over the field and the use of strips of paper weighted at one end rather than large sheets of paper that have little motion.

In most of the cases observed this method did not give complete protection, although in a few it was clearly successful. In localities where the crops attacked are germinated in water-saturated soil or are irrigated several times during the period of attack, this method has little merit.

STAKES AND FLAGS

Next in merit in the progressive study of horned lark repulsion is the "stake and flag" method. Here stakes, often laths, are fixed in the soil and strips of cloth or paper attached to their tops. The "flag" usually is tied to the top of the stake with a short string, but sometimes it is tacked in that position. Flagging affords crop protection in direct ratio to the density of stakes and flags, and to the care given in replacing flags torn away by wind or rain. For complete protection the stakes cannot safely be placed more than 25 feet apart in each direction, and in the case of persistent attack should be not more than 20 feet apart.

CONTINUOUS STRING FLAGGING

The best of the protective methods observed, namely, "continuous string flagging," has come into wide use during the past few seasons. The materials necessary are:

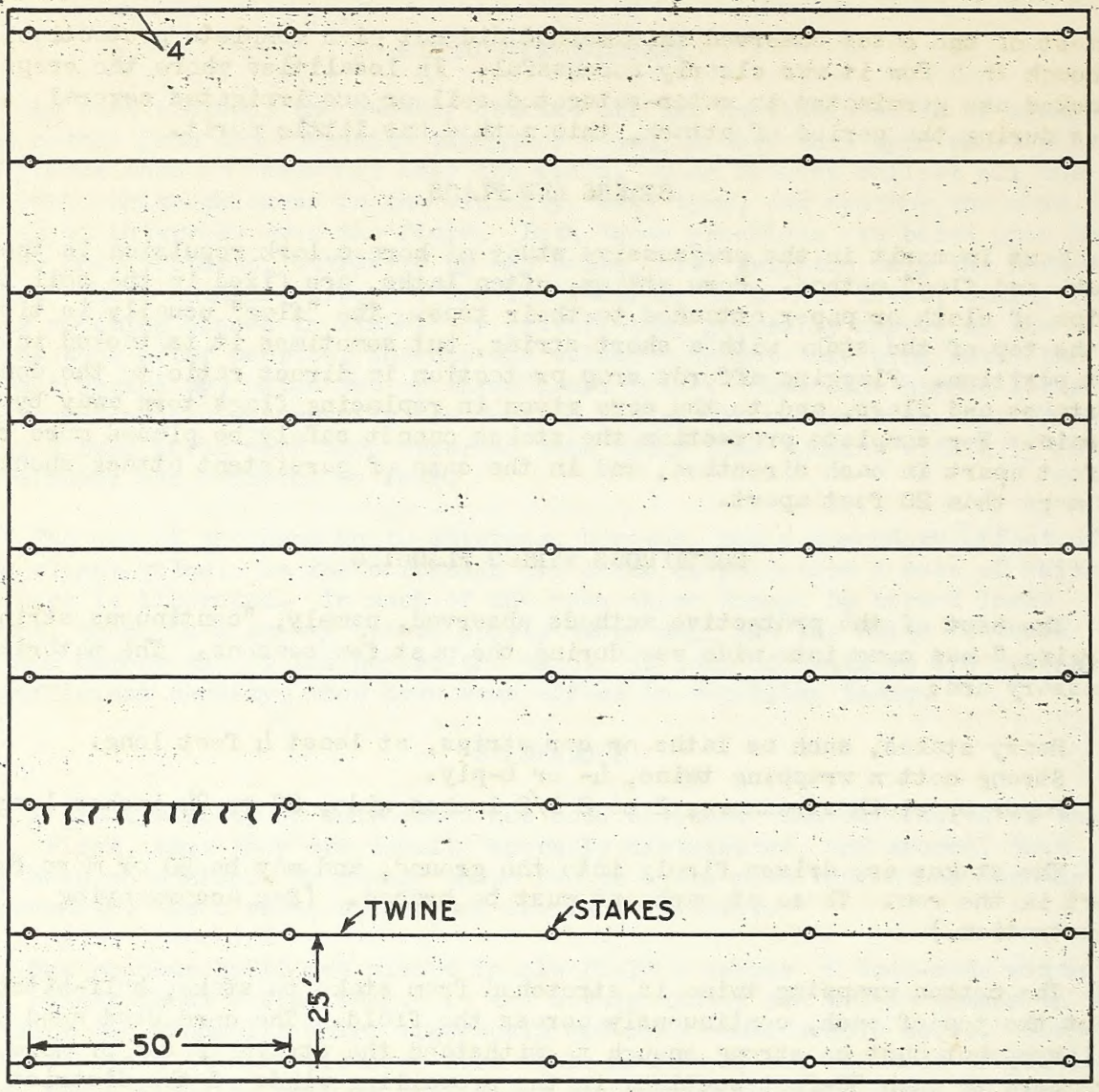
Heavy stakes, such as laths or car strips, at least 4 feet long.
Strong cotton wrapping twine, 4- or 6-ply.
Paper or cloth streamers, 2 to 2 1/2 inches wide, 20 to 24 inches long.

The stakes are driven firmly into the ground, and may be 50 or more feet apart in the row. Those at each end must be braced. (See accompanying illustration.)

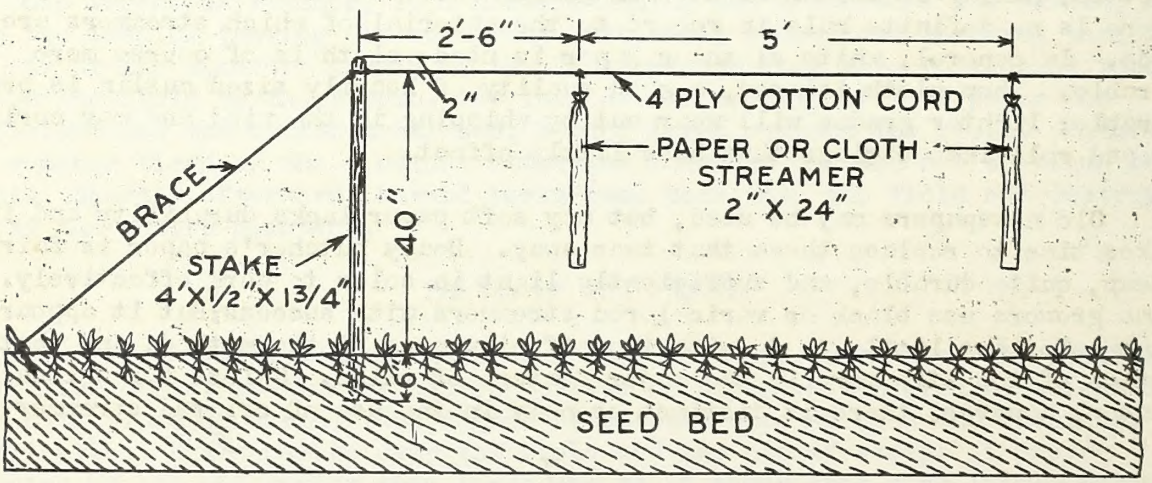
The cotton wrapping twine is stretched from stake to stake, half-hitched about the top of each, continuously across the field. The cord used need not be large, but must be strong enough to withstand the strain of ten or more streamers to each 50-foot section, in the prevailing winds of the district where used. Four-ply cotton wrapping twine is standard.

Paper or cloth streamers 2 to 2 1/2 inches wide by 20 to 24 inches long are prepared. These streamers should be fastened to the cord at 5-foot intervals, making 10 streamers to each 50-foot section between the stakes. There is no definite rule in regard to the material of which streamers are made. In general, white cloth or paper is used; cloth is of course more durable. When cloth is used, a good quality of heavily sized muslin is preferable; lighter grades will wear out by whipping in the wind and may curl up and roll into strings that have little effect.

Old newspapers may be used, but any soft paper lacks durability and it takes time to replace those that tear away. Heavy butcher's paper is fairly cheap, quite durable, and sufficiently light in color to work effectively. Some growers use black or varicolored streamers with success; but it appears that color has little to do with the effectiveness of the method, and that the motion of the streamers is the major feature of value. Unless for a local reason, however, there is distinct economy in the use of colored streamers,



PLAN FOR STAKING AND FLAGGING ONE ACRE.
208' X 208'



PLAN OF END STAKE AND FIRST TWO STREAMERS
CONTINUOUS STRING FLAGGING

42180

it is well to use white because of better visibility. Additional effect may be obtained if the rancher plants his crop in rows at a wide angle to the prevailing wind direction, and thus obtains greater motion of the streamers.

One rancher employed the waxed paper used for lining lettuce crates, which was cut into streamers 2 1/2 by 21 inches, the tail of each streamer being slit for fully 15 inches. This was in a locality where the daily sea breeze was strong, and the split streamers attained a maximum of motion, accompanied by a crackling and snapping noise that could be heard for a long distance. Horned larks showed a marked aversion to the noise of these streamers and would not even fly over the fields except at a considerable height. A two-ply, heavy crepe paper, the two plies stuck together with asphaltum, also is used. It is durable and will stand up in heavy wind and through severe rains. Split-tailed streamers of this paper are said to be very noisy and effective. It is reported to be cheaper than muslin and more durable than the cloth streamers.

When paper streamers are to be used it is suggested that prices including cutting be obtained from a local company. Machine cutting of the streamers at the paper mill will add little to the cost, while cutting streamers by hand on the ranch is a long and laborious task.

Paper streamers may either be pinned to the cord or tied to it with a short string; the latter is considered best as it permits maximum motion. The end of the streamer must be folded back so as to give additional strength where tied. When the period of damage has passed, the streamers should be removed from the cord and the cord rolled up and preserved for use the following season.

Cloth streamers also may be tied to the cord with a short string, or they may be knotted directly to the cord as it is being stretched from stake to stake. When cloth streamers are used, the cord with streamers attached may be wound upon notched boards and kept intact until again needed.

Many of the crops attacked by horned larks are grown in bed-rows; others are grown in single rows on a flat-surfaced field. The distance between rows or beds will determine the exact distance between the rows of stakes and streamers. For example, in a bed-rowed crop where the centers of the beds are exactly 27 inches apart, a row of stakes can be placed in the center of each tenth bed, or about 23 feet apart, or in the center of each twelfth bed, or 28 feet apart. The rows of stakes and streamers should never be placed more than 30 feet apart, and it is doubtful whether any situation would arise that would demand the placing of the rows closer than 20 feet apart. In common field usage the rows of stakes average about 25 feet apart.

This method of protecting plantlets against attack by horned larks is strongly recommended to agricultural officials and ranchers faced with this problem. When properly done it is an efficient method of preventing loss. No time should be wasted on trials of uncertain and less efficient methods. It is best to install continuous string flagging in advance of, or at the first sign of, attack upon the crop.

The recommendations presented in this leaflet are based on experimental work with horned larks in California. They may or may not be effective against other species or at other points.

ESTIMATE OF COSTS OF CONTINUOUS STRING FLAGGING

The cost of applying the continuous string flagging method is moderate when one considers the immense losses sometimes occasioned by failure to protect highly valuable crops. The estimates here given are based upon materials necessary to stake and flag one acre, 208 x 208 feet, with the stakes placed 50 feet apart in the rows, and the rows 25 feet apart. It should be noted that in the illustrated specimen acre the stakes and flags are carried to the margin of the acre; the stakes on the boundary, therefore, will serve the adjacent acre which will thus require one less row of stakes excepting at the ends of the field.

Costs of staking and flagging vary with the local labor costs and with fluctuations in prices of materials. For materials alone, in 1936, the cost ranged from 85¢ per acre with paper streamers to $1.85 per acre with cloth streamers. Costs quoted in Wildlife Research and Management Leaflet BS-64, of September 1936, were obtained in January 1936 in the trading center of an area in which hundreds of acres of crops were protected each year by this method. Revised costs listed below were obtained in the same trading center in May 1948.

Stakes:

Lath, 4-foot, #1	$2.10 per hundred.
Lath, 4-foot, #2	2.00 per hundred.
Car strips, 4' x 1/2" x 1-3/4"	3.00 per hundred.

Twine:

Four-ply cotton wrapping twine may be procured in balls and cones of varying weight. The best grades run about 2,000 linear feet per pound. Price offered on a two pound ball . . $1.60 per ball.

Streamers:

White muslin, good grade heavily sized, the regulation belts running 540 square feet (36 inches by 180 feet). Prices at 50¢ per yard.

Heavy, light-tan butcher's paper. A 24-inch roll, approximately 4,000 linear feet, weighing 30 to 35 pounds, is priced at 9½¢ per pound.

Streamers already cut, 2" x 24", from waxed lettuce paper are priced at 23¢ per hundred.

The same sized streamers cut from parchment paper are priced at 36¢ per hundred.

For the basic acre to be flagged the following materials should cost:

With muslin:

Stakes (car strips)--45	$1.35
4-ply cotton wrapping twine--2,000 feet 3/(See p.11)	.80
Muslin streamers, 2 x 24 inches,--360	6.75
	$8.90

With paper:

Stakes (car strips)--45	$1.35
4-ply cotton wrapping twine--2,000 feet 3/.	.80
360 already cut waxed lettuce paper streamers . . .	.69
	$2.84

Use of already cut parchment paper streamer would increase cost to $3.23

Use of heavy tan butchers paper would reduce the cost to approximately $2.50

3/ Based on offer of 2 pound ball or cone at $1.60. 1,800 linear feet is required for the continuous string, and 200 feet are allowed for tying.

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